

What is Claimed:

1. A method of operating a corona discharge device comprising the steps of:
producing a high-intensity electric field in an immediate vicinity of a corona electrode and

heating at least a portion of the corona electrode to a temperature sufficient to mitigate an undesirable effect of an impurity formed on said corona electrode.

2. The method according to claim 1 wherein said portion of said corona electrode comprises a metal or alloy including a metal selected from the group consisting of silver, lead, zinc and cadmium.

3. The method according to claim 1 wherein said portion of said corona electrode is heated to attain a temperature T given by the equation

$$T > \Delta H^{\circ}_{\text{rxn}} / \Delta S^{\circ}_{\text{rxn}}$$

where $\Delta H^{\circ}_{\text{rxn}}$ is the standard state enthalpy ($\Delta H^{\circ}_{\text{rxn}}$) and $\Delta S^{\circ}_{\text{rxn}}$ is the standard state entropy changes for the oxidation process of a surface material of said corona electrode.

4. The method according to claim 1 wherein said step of producing a high intensity electric field includes applying a voltage to said corona electrode sufficient to cause a corona discharge from said corona electrode.

5. The method according to claim 1 wherein said step of heating is performed continuously.

6. The method according to claim 1 wherein said steps of producing a high intensity electric field and heating are performed simultaneously.

7. The method according to claim 1 wherein said step of heating is performed periodically.

8. The method according to claim 1 wherein said steps of producing a high intensity electric field and heating do not overlap.

9. The method according to claim 1 wherein said portion of said corona electrode comprises a material that oxidizes under the influence of air and/or the alloy containing such a material.

10. The method according to claim 1 wherein said step of periodically heating includes a step of monitoring a characteristic of said corona electrode and, in response, heating said portion of said corona electrode.

11. The method according to claim 10 wherein said characteristic is an electrical resistivity of said corona electrode or a portion of that electrode.

12. The method according to claim 10 wherein said characteristic is an electrical conductivity of said corona electrode or a portion of that electrode.

13. The method according to claim 1 wherein said step of periodically heating includes a step of terminating a heating of said corona electrode in response to detecting a predetermined electrical characteristic of said corona electrode.

14. The method according to claim 13 wherein said electrical characteristic includes a characteristic selected from the group consisting of resistivity, conductivity, resonant frequency, and electromagnetic susceptibility.

15. The method claim 1 wherein said step of periodically heating includes a step of measuring a period of time since a last heating cycle and, in response to a lapse of a predetermined time period, heating said portion of said corona electrode.

16. The method according to claim 1 wherein said step of periodically heating includes a step of measuring a time period of a current heating cycle and, in response to expiration of a predetermined period of time, terminating the current heating cycle.

17. The method according to claim 1 including the steps of terminating said step of producing prior to initiating said step of periodically heating and, upon completion of said step of periodically heating, reinitiating said step of producing said high-intensity electric field.

18. A method of operating a corona discharge device comprising the steps of:
producing a high-intensity electric field in an immediate vicinity of a plurality of corona electrodes;

detecting a condition indicative of initiation of a corona electrode cleaning cycle;

interrupting application of a high voltage to at least a portion of said corona electrodes so as to terminate said step of producing said high-intensity electric field with regard to that portion of corona electrodes;

applying a heating current to said portion of said corona electrodes sufficient to raise a temperature thereof resulting in at least partial elimination of an impurity formed on said portion of said corona electrodes; and

reapplying said high voltage to said portion of said corona electrodes so as to continue producing said high-intensity electric field with regard to that portion of corona electrodes.

19. The method according to claim 18 wherein said plurality of corona electrodes are divided into a plurality of said portions and said step of applying said heating current is repeated with respect to each of said portions.

20. The method according to claim 18 wherein said repeated application of said heating current to each of said portions of said corona electrodes is completed for all of said plurality of corona electrodes prior to said step of reapplying said high voltage to any of said portions of said corona electrodes.

21. The method according to claim 18 wherein said plurality of corona electrodes are divided into a plurality of said portions and said steps of interrupting application of a high voltage, applying said heating current, and reapplying said high voltage are performed serially for each of said portions of corona electrodes so that said high voltage is interrupted, and said heating current is applied, to a single portion of said corona electrodes at any one time, the other portions continuing to have said high-voltage applied thereto.

22. A corona discharge device comprising:

- a. a high voltage power supply connected to corona electrodes generating a high intensity electric field;
- b. a low voltage power supply connected to said corona electrodes for resistively heating said corona electrodes; and
- c. control circuitry for selectively connecting said high voltage power supply and low voltage power supply to said corona electrodes.

23. The corona discharge device according to claim 22 wherein said corona electrodes include a surface material selected from the group consisting of silver, lead, zinc and cadmium.

24. The corona discharge device according to claim 22 wherein said low voltage power supply is configured to heat said electrodes to attain a temperature T given by the equation

$$T > \Delta H^{\circ}_{\text{rxn}} / \Delta S^{\circ}_{\text{rxn}}$$

where $\Delta H^{\circ}_{\text{rxn}}$ is the standard state enthalpy ($\Delta H^{\circ}_{\text{rxn}}$) and $\Delta S^{\circ}_{\text{rxn}}$ is the standard state entropy changes for the oxidation process of a surface material of said corona electrode.

25. A corona discharge device according to claim 22 further including a timer, said control circuitry responsive to said timer for periodically applying said low voltage to said corona electrodes.

26. The corona discharge device according to claim 22 wherein said control circuitry comprises a switch.

27. The corona discharge device according to claim 22 further comprising measurement circuitry configured to provide an indication of a condition of said corona electrodes, said control circuitry responsive to said indication for applying said low voltage to said corona electrodes.

28. The corona discharge device according to claim 27 wherein said measurement circuitry indicates an electrical resistance of said corona electrodes.

29. The corona discharge device according to claim 22 wherein said low voltage power supply is configured to supply a controlled magnitude of electric power to said corona electrodes.

30. The corona discharge device according to claim 22 wherein said low voltage power supply is configured to periodically accumulate and discharge a controlled amount of electromagnetic energy to said corona electrodes.

31. The corona discharge device according to claim 22 wherein said low voltage power supply comprises a fly-back power converter.

32. A method of generating a corona discharge comprising the steps of:
generating a high intensity electric field in a vicinity of a corona electrode;

converting a portion of an initial corona electrode material of said corona electrode using a chemical reaction that decreases generation of a corona discharge by-product; and

heating the corona electrode to a temperature sufficient to substantially restore the converted part of the corona electrode material back to the initial corona electrode material.

33. The method according to claim 32 wherein said corona discharge by-product comprises ozone.